

MANISH VERMA

Carbon and Ecosystems Group
Jet Propulsion Laboratory
California Institute of Technology
4800 Oak Grove Drive, Pasadena, CA 91109
E-mail: manish@caltech.edu
Phone: 626-628-5070

EDUCATION

Ph.D. (2013)	Department of Earth and Environment, Boston University, USA
M.Sc. (1994)	Indian Institute of Forest Management, Bhopal, India
M.A.-Mathematics (1992)	Barkatullah University, Bhopal, India
B.A.- Mathematics (1988)	Barkatullah University, Bhopal, India

CURRENT POSITION

California Institute of Technology Postdoctoral Scholar, Jet Propulsion Laboratory, 2013-Present

PEER-REVIEWED PUBLICATIONS**[Published/Accepted]**

Ganguly S, Friedl MA, Tan B, Zhang X and **Verma M**: *Land Surface Phenology from MODIS: Characterization of the Collection 5 Global Land Cover Dynamics Product*, Remote Sensing of Environment, 114, 1805-1816, 2010, doi:10.1016/j.rse.2010.04.005.

Verma M, Friedl MA, Richardson AD, Kiely G, Cescatti A, Law, BE, Wohlfahrt G, Gielen B, Roupsard O, Moors E J, Toscano P, Vaccari FP, Gianelle D, Bohrer G, Varlagin A, Buchmann N, van Gorsel E, Montagnani L, and Propastin P: *Remote sensing of annual terrestrial gross primary productivity from MODIS: an assessment using the FLUXNET La Thuile data set*, Biogeosciences, 11, 2185-2200, 2014, doi:10.5194/bg-11-2185-2014.

Verma M, Friedl MA, Law BE, Bonal D, Kiely G, Cescatti A, Wohlfahrt G, Roupsard O, Moors EJ, Toscano P, Vaccari FP, Varlagin A, Marcolla B, Montagnani L, Black TA, Arain A, and D'Odorico P: *Improving the performance of remote sensing models for capturing intra- and inter-annual variations in daily GPP: An analysis using global FLUXNET tower data*, Agricultural and Forest Meteorology, 214-215, 416-429, 2015, doi:10.1016/j.agrformet.2015.09.005.

Verma M, Friedl MA, Finzi A, and Phillips N: *Multi-criteria evaluation of the suitability of growth functions for modeling remotely sensed phenology*, Ecological Modelling, 323, 123-132, 2016, doi:10.1016 /j.ecolmodel/2015.12.005.

Frankenberg C, Drewry D, Geier G, **Verma M**, Lawson P, Stutz J, and Grossmann K: *Remote sensing of solar induced chlorophyll fluorescence from satellite, airplanes and ground-based stations*, [Accepted, Proceedings of IGARSS, 2016].

[In Revision]

Jeong SJ, Schimel D, Frankenberg C, Drewry D, Fisher J, **Verma M**, Berry J, Lee JE, Joiner J, and Guanter L, *Application of satellite solar-induced chlorophyll fluorescence to understanding large-scale variations in vegetation seasonal cycle and phenology over northern high latitude forests*, Remote Sensing of Environment.

[In Review]

Verma M, Fisher JB, Mallick K, Ryu Y, Kobayashi K, Guillaume A, Moore G, Ramkrishnan L, Hendrix V, Wolfe S, Sikka M, Kiely G, Wohlfahrt G, Arain A, Roupsard O, Toscano P, Gielen B, and Cascatti A, *Global Daily Surface Net-radiation at 5 km from MODIS Terra*, International Journal of Applied Earth Observation and Geoinformation.

[In Preparation]

Verma M, Fisher JB, Moore G, Guillaume A, Mallick K, and Kevin T: *New, fine resolution estimates of ET and its components, and their application in the evaluation of CMIP5 models*, Journal of Hydrology.

Verma M, Schimel D, Frankenberg C, Drewry D, Evans B, Jason B, Hutley L, Marang I, and Caitlin M: *Does solar induced fluorescence from OCO-2 improve our understanding of terrestrial carbon cycle: an analysis at OzFLUX sites*, Biogeosciences (Special Issue on “OzFlux: a network for the study of ecosystem carbon and water dynamics across Australia and New Zealand”).

REPORTS AND OTHER PUBLICATIONS

Moore, G., **Verma, M.**, and Fisher, J., *Net Radiation and Evapotranspiration (Rn/ET) Download Product Tools and Interfaces* (to be published in NASA Tech Brief)

Bose S, Lal P, Pareek PS, **Verma M**, and Saigal S, *Forest Based Associations in India*, Winrock International, Delhi, India & International Institute for Environment and Development, London, UK, 2006.

Verma M, *Joint Forest Management in AKRSP's South Gujarat Programme Area: Issues, Challenges, and Options*, Aga Khan Rural Support Programme (India), Ahmedabad, 2005.

Verma, M, *Applying Design Principles for Joint Forest Management in India*, Digital Library of Commons, Indiana University, 2004.

Senior Member of the project team, *The Madhya Pradesh Human Development Report*, Government of Madhya Pradesh, 1998

GEOSPATIAL COMPUTATION

SOFTWARE

Big Data	Parallel and distributed computing on Linux cluster using Python and MATLAB
----------	---

Computing	Python, MATLAB, R, Mathematica, Fortran
Image processing	MATLAB, Mathematica, ENVI/IDL, Python
GIS	Python, R, QGIS, ArcGIS, GDAL, MATLAB, Mathematica
OS	Unix, Mac, Shell Scripting, Windows

QUANTITATIVE TECHNIQUES

Multi-sensor data fusion, spatial- and geo-statistics, dynamic model simulation, model parametrization, model inversion, multi-criteria model validation, canopy radiative transfer, unsupervised and supervised classifications, clustering, decision tree, random forest, neural network, data assimilation, uncertainty and error characterization, composite indices

SENSORS

MODIS, Landsat, AVHRR, OCO-2, SMAP, SPOT-VEGETATION, SRTM, GOME, Airborne Spectrometer, LiDAR, Digital Camera, radiometers and spectrometers, sensors and data loggers from Li-COR and Campbell Scientific

SOFTWARE LICENSE

One of the three contributors to *Net Radiation and Evapotranspiration (Rn/ET) Download Product Tools and Interfaces*

ADVISING

Co-advising a Ph.D. student at University of Sydney (Main advisor is Prof Bradley Evans from U of Sydney)

Co-advised 2 NASA DEVELOP fellows in summer 2015.

Supervised and trained a research assistant for remote sensing and GIS related tasks for two years (2013 to 2015) in JPL.

CONTRIBUTION TO OPEN ACCESS FIELD DATA

Canopy Phenology, Remote Sensing and Microclimate at Harvard Forest since 2006: Mark Friedl, Nathan Phillips, **Manish Verma**, and Eli Melaas, Harvard Forest Data Archive.

PRESENTATIONS AND TALKS

Verma M, Evans B, and Schimel D: *Potential of solar induced fluorescence (SIF) from OCO-2 for improved monitoring of terrestrial carbon cycle*, Climate Centre, Jet Propulsion Laboratory, Pasadena, USA, 2016.

Verma M, Evans B, Schimel D, Frankenberg C, Drewry D, Eldring A, Gunson M, Evans B, Jason B, Hutley L, and Moore CI: *Potential of solar induced fluorescence (SIF) for the improved estimation GPP*, University of Technology, Sydney, Australia, 2016.

Verma M, Schimel D, Frankenberg C, Drewry D, Eldring A, Gunson M, Evans B, Jason B, Hutley L, Moore C, and Marang I: *Validation and attribution of solar induced fluorescence (SIF) from OCO-2: First results*, American Geophysical Union, San Francisco, USA, 2015.

Drewry D, Frankenberg C, **Verma M**, Berry J, Schimel D, Geier S, and Schwochert M: *The Chlorophyll Fluorescence Imaging Spectrometer (CFIS): A New Airborne Instrument for Quantifying Solar-induced Fluorescence*, American Geophysical Union, San Francisco, USA, 2015.

Verma M, Schimel D, Frankenberg C, Evans B, Jason B, Hutley L, Moore C: *Combining OCO-2 SIF and MODIS reflectance with PROSAIL and SCOPE models to retrieve Vcmax*, Carbon Club Seminar, Jet Propulsion Laboratory, Pasadena, USA, 2015.

Verma M, Fisher JB, Mallick K, Ryu Y, Kobayashi K, Guillaume A, Moore G, Ramkrishnan L, and Hendrix V: *Evaluating ET and its components from CMIP5 with new, high resolution, remote sensing-based estimates*, American Geophysical Union, San Francisco, USA, 2014.

Jeong SJ, Schimel D, Frankenberg C, Drewry D, Fisher JB, **Verma M**, Berry J, Lee JE, Joiner J, and Guanter L: *Seasonal decoupling between vegetation greenness and function over northern high latitude forests*, American Geophysical Union, San Francisco, USA, 2014.

Verma M, Friedl MA, Richardson AD, Kiely G, Cescatti A, Law, BE, Wohlfahrt G, Gielen B, Roupsard O, Moors E J, Toscano P, Vaccari FP, Gianelle D, Bohrer G, Varlagin A, Buchmann N, van Gorsel E, Montagnani L, and Propastin P: *Controls on spatial and temporal variation in GPP: An analysis using the FLUXNET "La Thuile" Data*, Carbon Cycle Science Meeting, Jet Propulsion Laboratory, Pasadena, USA, 2014.

Verma M, Friedl MA, Law BE, Bonal D, Kiely G, Cescatti A, Wohlfahrt G, Roupsard O, Moors EJ, Toscano P, Vaccari FP, Varlagin A, Marcolla B, Montagnani L, Black TA, Arain A, and D'Odorico P: *Carbon Cycle Science Meeting, Jet Propulsion Laboratory, Pasadena, USA, 2014: Are data-based models better in tracking spatiotemporal variation in GPP*, TSAM Meeting, Jet Propulsion Laboratory, Pasadena, USA, 2014.

Verma M: *Applied Science Ph.D. Programs in the US: What Does It Take to Get in and Survive*, Indian Institute of Forest Management, Bhopal, India, 2013.

Verma M, Friedl MA, and Phillips N: *Validation of MODIS Phenology Using in-situ Light Interception Data*, Woods-Hole-Boston-University Joint Meeting for Terrestrial Biogeochemistry, Woods Hole, USA, 2010.

Verma M, Friedl MA, Phillips N, and Richardson A: *Using Light Interception and in-Situ Surface Reflectance in Support of Moderate Resolution Remotely Sensed Phenology*, International Geoscience and Remote Sensing Symposium, Boston, USA, 2008.

Friedl MA, Ganguly S, Tan B, and **Verma M**: *Global 500-m Estimates Of Land Surface Phenology For 2001-2008 From MODIS*, American Geophysical Union, San Francisco, USA, 2008.

Verma M, and Malik A: *Sustainable Management of Forest and Non-Timber-Forest-Products-*

Based Livelihoods in Tribal Area, Symposium on Forest and Livelihoods, Tropical Forest Research Institute, Jabalpur, India, 2006.

Verma M, *Ecology of Arid Areas and Natural Resources Based Livelihoods in Kutch*, Stakeholders' Meeting Organized by OXFAM, Lakhpat, India, 2006.

Verma M, *Adoption of Irrigation by Small and Marginal Tribal Farmers: What Works and What Doesn't*, Evidences from Banswara District, IWMI-TATA Water Policy Conference, Anand, India, 2004.

Verma M, *Ecological and Institutional Aspects in the Governance of Natural Resources*, Stakeholders' Workshop, Udaipur, India, 2004.

Verma M, *The Role of Common Property Resources in Surviving Droughts*, A Presentation to the Indian Administrative Services Probationers, Anand, Gujarat, 2002.

WORKSHOPS AND POSTERS

OCO-2 Science Meeting, California Institute of Technology, Pasadena, 2015

HysPIRI Science and Application, California Institute of Technology, Pasadena, 2015

Exploring New Multi-Instrument Approaches to Observing Terrestrial Ecosystems and the Carbon Cycle from Space, Keck Institute for Space Studies, California Institute of Technology, Pasadena, USA, 2015 [Invited].

The Coupled Carbon and Water Cycles, California Institute of Technology, Pasadena, 2014 [Invited].

Global daily net-radiation in all-sky conditions at 5 km from MODIS: algorithm development, validation, and evaluation of coarse resolution gridded net-radiation products, Jet Propulsion Laboratory, Postdoctoral Research Day, 2014.

Water Management Workshop with the Students of University of California, Irvine, Jet Propulsion Laboratory, Pasadena, USA, 2015.

AWARD

Fellowship from the Ministry of Environment and Forest, India

Director's Medal at the Indian Institute of Forest Management

Erasmus Mundus Fellowship from European Union (Declined)

University President Fellowship, Boston University

Graduate Research Assistantship, Boston University

California Institute of Technology Postdoctoral Scholar at JPL

SCIENCE OUTREACH ACTIVITIES

Science judge and mentor in several school level science fair including Intel International Science Fair, Los Angeles County Science Fair, California State Science Fair, and Science Bowl.

Participated in different capacities in JPL's outreach activities such as Eyes on Earth Exhibit and JPL Open House.

Recognised as an '**Outstanding Volunteer**' at JPL and by the California State Science Fair.

PROFESSIONAL SERVICE

Reviewer: Remote Sensing of Environment, International Journal of Applied Earth Observation and Geoinformation, Journal of Geophysical Research, Global Change Biology, Journal of Hydrology, Remote Sensing

Judge: AGU student presentations 2014, 2015

CONTINUED PROFESSIONAL EDUCATION (SHORT COURSES)

Geoscience Paper of the Future, Jet Propulsion Laboratory, 2015

Statistics School for Postdoc with R, California Institute of Technology, 2014

Tuning Matlab Code for Better Performance, Boston University, Boston, USA, 2012

Parallel Computing in Matlab, Boston University, Boston, USA, 2011

Visualizing Scientific Data with Matlab, Boston University, Boston, USA, 2009

Advance Unix, Boston University, Boston, USA, 2008

Increasing Efficiency and Productivity in Workplace, Foundation for Ecological Security, Anand, India, 2002

Biophysical Aspects in Watershed Management, Watershed Management Training Centre, Dewas, India, 2001

Data Analysis for Monitoring and Evaluation, Gujarat Institute of Development Research, Ahmedabad, India, 1996

Communication for Development Action, VIKSAT, Ahmedabad, India, 1995